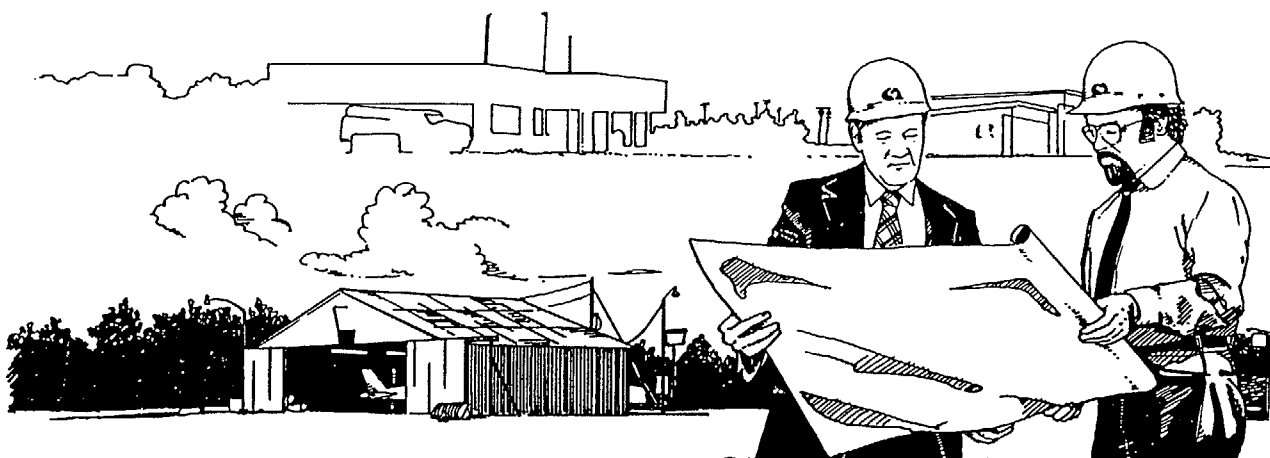


Chapter Five
DEVELOPMENT ALTERNATIVES



Chapter Five

DEVELOPMENT ALTERNATIVES

Flagstaff Pulliam Airport

The next step in the master planning process is the identification and evaluation of development alternatives. This may be the most important step since the decisions made concerning the future development of airport facilities will influence management of the airport's assets throughout the planning period. In evaluating the various ways facilities can be constructed, there are countless combinations and alternatives that must be reviewed. The influence of cost, terrain, utilities, land ownership, existing facilities and a myriad of other factors requires the planner to use intuitive judgment in identifying those alternatives which provide the greatest potential for implementation.

The development alternatives for Flagstaff Pulliam Airport can be categorized into three functional areas: the airfield, the airline terminal area and the general aviation area. Within each of these areas, specific facilities are required or desired. Although each functional area is treated separately, planning

must integrate the individual requirements so that they complement one another.

The total impact of all of these factors on the existing airport must be evaluated to determine if the investment in Flagstaff Pulliam Airport will meet the aviation needs of the region during and beyond the planning period. However, before beginning this process, consideration must also be given to a "do nothing" or "no build" alternative as well as the possibility of relocating the airport to another site altogether. As these alternatives are not without major impacts and costs to the public they are also addressed in this chapter.

DO NOTHING ALTERNATIVE

The do nothing alternative would mean that the airport would be retained in its present condition with no improvements made to the

existing facilities. The primary result of this alternative, as in any growing air transportation market, would be the inability of the airport to satisfy the increasing aviation demands. In fact, some airport facilities, such as the terminal building and general aviation hangars require immediate attention in order to meet current demand. A precision instrument approach is required to support the increase in airline activity and enhance safety during inclement weather.

By not providing new terminal facilities, the existing terminal will become so crowded by the growing numbers of passengers that deterioration will take place more rapidly and the quality of service will suffer significantly. The automobile parking lot is also unable to accommodate the number of vehicles utilizing the existing area.

By not providing for improvements and expansion the viability of the airport as an asset to the community becomes questionable. Surely the growing Flagstaff area would be seriously affected by offering a substandard transportation facility to potential businesses considering locating in the area. The *do nothing* alternative is inconsistent with the long term goal of the City of Flagstaff, the State of Arizona and the Federal Aviation Administration which is to enhance local and interstate commerce, and would also affect the long term viability of the airport. The *do nothing* alternative is not considered to be prudent or feasible.

TRANSFERRING DEMAND TO ANOTHER AIRPORT

Transferring aviation demand to another airport does not appear feasible since there are no other airports within close proximity to the Flagstaff Pulliam Airport that have the necessary facilities for the type of aircraft currently using the airport. The closest airport with facilities that could accommodate commercial service is Grand Canyon National

Park Airport in Grand Canyon, Arizona, approximately 60 air miles north of the airport. Other airports in the area are Williams Municipal and Sedona airports, where an extensive modification of facilities and improved runways would be required in order to accommodate the existing demand. Development at either of these two facilities would be nearly the equivalent of developing an entirely new airport.

Transferring aviation demand to Grand Canyon National Park Airport would not serve the business or recreational passenger to the Flagstaff area. Due to its greater distance from the area, it would result in a longer distance to travel and, therefore, more inconvenience to the passenger. Grand Canyon National Park Airport is also experiencing a great deal of aviation growth and activity. The additional impact of general aviation and airline demand at this time would place an enormous strain on the existing facilities.

The Sedona and Williams airports, although closer to Flagstaff, are even less capable of accommodating the existing Flagstaff demand without an inordinate increase in the capacity, capability and infrastructure of the airports. There would be a significant environmental impact at both of these facilities as well.

The alternative of transferring existing aviation demands to another airport was found to be undesirable because none of the existing airports could accommodate this demand.

ESTABLISH A NEW AIRPORT

This alternative, due to the significant economic and environmental impacts that it entails, is normally discounted as a viable alternative to the development of the existing airport. The public controversy that surrounds the establishment of a new airport normally centers on the environmental issues

and cost. In the paragraphs that follow, a brief discussion of some of the factors and a description of their impacts will explain the complexities involved in establishing a new airport.

- **Land Acquisition:** A new airport would require at least as much property as the existing airport (approximately 600 acres). An airport should be constructed on land where there is the least encumbrance on the property. With this in mind, state and privately owned land were considered preferable for development, although federal lands should not be ruled out.
- **Runway Length:** The length of the runway at a new airport will need to be capable of accommodating the existing aircraft at Flagstaff Pulliam Airport. The runway length will be predicated on the airport elevation, temperature and gradient. Existing elevations in the vicinity of Flagstaff require a runway length between 7,000 and 8,300 feet.
- **Accessibility:** A new airport should be in close proximity to a major highway, interstate, or improved road with direct access to Flagstaff.
- **Cost:** The alternative of developing an entirely new airport facility requires an analysis of the cost of the existing facility compared with its replacement cost. The existing facility is valued at approximately \$11.6 million (exclusive of depreciation). It is estimated that the cost of a new facility would range between two to three times as much (\$22 to \$32 million) depending upon engineering and environmental factors.

The single most limiting factor in the development of an airport is the cost. The cost must be viewed in at least two ways: development cost of a new airport and the financial investment in the existing airport. There is no apparent value to the existing

airport property if the airport is abandoned in order to construct a new airport at another location. The deed to the existing property contains a reversion clause that requires the property to revert back to the U.S. Department of Agriculture (U.S. Forest Service) if the property is not used for airport purposes. In essence, the value of the existing property is lost.

- **Environmental Process:** The establishment of a new airport would require the City of Flagstaff to subject the plan to the Environmental Impact Process. This process, on average, can take in excess of two years to complete, with no assurance that environmental approval for new airport construction will be received. During this process, alternatives to the establishment of a new airport will be evaluated to determine if another alternative would result in less environmental impact. If there are other alternatives that can successfully compete with the proposed new airport, one can anticipate that approval of the proposal is highly unlikely.

SUMMARY

In conclusion, the best alternative from a cost and environmental impact standpoint appears to be development of the existing airport. The development of a new airport must meet the same tests for viability that the existing airport must meet. Before one commits to such an endeavor, there should be a significant reason to move the airport from its present location, a reason that overrides the commitment of money, time, effort and environmental impact that has been expended in the existing facility.

The Federal government, the State of Arizona and the City of Flagstaff (ostensibly, its citizens), have invested a great deal of money in the existing airport over the years.

Private financial investment has also been substantial at the airport. Most of this investment will be lost if the airport is transferred to another site.

Circumstances require that serious consideration be given to the improvement of the existing airport before undertaking a new airport. It is almost certain that the airport is capable of meeting the demand forecast for the next 20 years at Flagstaff Pulliam Airport provided the facilities recommended in the previous chapter are constructed. Beyond the current planning period, Flagstaff Pulliam Airport may very well be able to accommodate the demand expected in another 20-period.

It is certain there are problems to overcome in the development of the existing facility. However, establishing an airport at another location will only result in ensuring the FAA design standards are met. It will not resolve problems with providing utilities, sufficient property, or environmental acceptance. Until all the development actions at the existing facility have been exhausted and a substantiated crisis prevails with the existing airport, it is recommended that the construction of a new airport be abandoned.

DEVELOPMENT OF THE EXISTING FACILITY

The examination of this alternative plays an important role in determining the emphasis to be placed on any or all of the other alternatives. If the existing facility cannot be developed to meet the forecast demand, then one or a combination of alternatives must be selected to achieve the desired result....which is to provide the necessary facilities to meet the forecast demand for aviation services in the Flagstaff area.

The first question that must be asked in analyzing the need for addressing other alternatives is whether or not there are

serious limitations to future expansion of the existing Flagstaff Pulliam Airport. Can Flagstaff Pulliam Airport meet the forecast demand for aviation services in the Flagstaff area in the short and the long term?

There are some limitations to development at Flagstaff Pulliam Airport which will require analysis and explanation. A brief discussion of each limitation and the effect it will have on the capability of the airport to expand and grow is discussed in the paragraphs that follows.

DESIGN STANDARDS

As mentioned in the previous chapters, Flagstaff Pulliam Airport was designed and constructed during a period when the separation standards for airports were not as stringent for certain airport types as are the existing standards. This is not a unique situation among general aviation or commercial service airports in the United States as a large number of airports are faced with similar problems.

The ability of the airport to comply with FAA design criteria was centered on maintaining specific separation clearances from the runway, taxiway and buildings. The two most significant separation standards that are not being met at Flagstaff Pulliam Airport are the distance between runway centerline and parallel taxiway (250 feet versus a design standard of 400 feet) and the distance between runway centerline and aircraft parking area (325-350 feet versus a design standard of 400 feet for nonprecision instrument runways and 500 feet for precision instrument runways).

The current design standards require buildings to be located at least 500 feet from the runway centerline. At the present time, all of the existing structures are in compliance with this standard. However, once a precision instrument approach capability is established

at the airport, the Building Restriction Line (BRL) changes to approximately 745 feet from the runway centerline.

Due to the unacceptable expense that would be incurred to relocate or reconstruct airport facilities to meet the established FAA criteria, a review of the Airport Layout Plan by FAA in March 1979 produced the following waivers.

- The standard dimensional clearance, runway centerline to parallel taxiway centerline, is 400 feet. The existing clearance is 250 feet. FAA granted a modification to the required clearance of 150 feet.
- The standard dimensional clearance, runway centerline to aircraft parking area is 500 feet. The existing clearance is 225 feet. FAA had no objection to the continued use of the existing apron (275 feet in width). However, all future aircraft parking apron must comply with the 500 foot separation distance.
- At the time the waiver was granted, the BRL standard separation for this airport was 750 feet. Therefore, many of the existing buildings were not in compliance at that time as some were within 500 feet of the runway centerline. The FAA allowed all buildings within the BRL to remain subject to being marked with obstruction lighting. Continued use of the area will require that all future buildings meet the FAA Part 77 criteria or be subject to an obstruction evaluation by FAA in order to determine whether the building might be a hazard to navigation.

The waivers granted by FAA are subject to review when the Airport Layout Plan is updated through the master plan process. It appears that prudent planning for future airport development will preclude any further problems with FAA airport design standards.

In summary, although the Flagstaff Pulliam Airport is unable to meet some of the current FAA design standards, there do not appear to be any insurmountable problems that would effect the ability of the airport to meet future demand during the planning period. The land necessary for future development is available and new facilities can be designed to comply with the existing design standards.

UTILITIES

The existing water and waste water disposal systems are not adequate to support continued expansion of the airport. The City has recognized this and secured voter approval to issue revenue bonds for the installation of a larger water line to support future airport development. These bonds were not issued because the airport revenue system could not support the amortization of revenue bonds. The City is in the process of obtaining authority to issue a general obligation bond for the same project. Another alternative, the installation of a water storage tank to store water for firefighting purposes, is also under consideration to support the fire flow requirements of a new terminal.

The connection of the airport to the waste water system of the City has not been accomplished, although the need for such a system has been identified. In the interim, septic tank systems, supporting the various facilities on the airport have been installed and are in operation. Although this method of waste-water treatment is not recommended for future development, septic systems can be used as an interim measure. If the City determines that connecting the airport to the existing sewer line is not economical, the establishment of a package treatment plant for the airport would be an alternative development proposal.

In summation, there are solutions to the waste-water treatment and water supply problems facing the existing airport. The capability exists to solve these problems and provide the necessary utilities to meet future expansion requirements.

IMPROVE AIRPORT CAPACITY

Although this master plan does not indicate that an increase in airport capacity is warranted during the 20-year period of this master plan, the location for a parallel runway should be examined. An evaluation of the existing airport property determined that a parallel runway could be accommodated east of the existing runway.

There is sufficient airport property available on the east side of the runway to construct a parallel runway with a separation of 700 feet between runway centerlines. This distance would provide the airport the ability to conduct simultaneous takeoff and landing operations from either runway during visual flight rule conditions. In addition, the analysis determined that a 5,900 foot long, 75 foot wide parallel runway, located on the east side of the airport, would meet the requirements for 75 percent of the small aircraft (with 10 passenger seats or less). This would increase the airport capacity sufficient to meet the demand anticipated at Flagstaff Pulliam Airport for the next 40 years.

It is recommended that the parallel be constructed so that the Runway 3L and 3R ends are coincident. Additional property will be necessary in order to accommodate runway safety areas, building restriction lines and runway protection zones east of the parallel runway. The size of the property required will be determined by the design criteria (Airplane Design Group) and the instrumentation provided to the runway (visual, nonprecision or precision).

LAND ACQUISITION

The airport property was acquired from the federal government under the Federal Airport Act of 1947. Stipulations within the deed agreement required that the land be used for aviation purposes. In 1984, the City secured congressional release from the restriction that all of the land be used for airport purposes and conducted a study to determine what, if any, airport property could be used for commercial and industrial purposes. The revenues received from the lease or sale of the property would be used to improve and expand airport facilities.

The study concluded that some land on the airport was in excess of that needed to support development of aviation activities and was subsequently released by FAA for an airport industrial park. Land is also being held in reserve on the airport for a crosswind runway, a runway that is not required at this airport due to the existing wind coverage. Most of the property surrounding the airport is administered by the U.S. Department of Agriculture (U.S. Forest Service). Should the airport need to acquire property for airside development, a potential exists to use some of the excess property in trade for land needed for airport purposes (runway protection zones, safety areas, building setbacks, etc.).

In summary, none of the requirements imposed on the airport by FAA design standards, providing proper utilities, or increasing capacity are insurmountable and the future expansion of the airport is not only possible but with prudent planning, some of the existing limitations will be minimized or eliminated. Therefore, the single most serious argument to abandon or terminate development at the existing airport . . . an inability to expand to meet future airport demand. . . is not a credible argument.

AIRPORT DEVELOPMENT ALTERNATIVES

The remainder of this chapter will discuss the potential development alternatives of the existing facilities, describing the salient characteristics of each alternative and the advantages and disadvantages of each alternative. Recommendations will be reviewed with the City staff in order to resolve the issues and provide a development program for the future of the Flagstaff Pulliam Airport.

In the previous chapter, Demand/Capacity and Facility Requirements, the airside and landside facilities required to satisfy forecast aviation demands throughout the planning period, were identified. The overall objective is to produce a balanced airside and landside complex to serve the projected demand. This section of the chapter will describe the potential directions for future development at the Flagstaff Pulliam Airport. The description of alternatives will be divided into two functional areas:

- Airside Alternatives
- Landside Alternatives

AIRSIDE ALTERNATIVES

Airfield facilities are by nature the focal point of the airport complex. Because of their primary role and the fact that they physically dominate airport land use, airfield requirements can be the most critical input to the identification of reasonable alternatives to airport development. In particular, runway and taxiway development have the greatest effect.

In the preceding chapter, the airside facilities were reviewed and recommendations made concerning runway length, runway and taxiway strength, navigational aids and marking and

lighting. These subjects will be discussed in the paragraphs that follow.

Runway Length

The two significant areas of airside development that are recommended at Flagstaff Pulliam Airport are a 1,300 foot by 150 foot runway extension and 1,300 by 50 foot parallel taxiway extension. Also included in the airside requirements is another taxiway exit to decrease the amount of time aircraft remain on the runway. Construction of all of these facilities would increase the capacity of the airport to meet forecast operational demand during the planning period.

In the previous master plan, a 1,200 foot extension to Runway 21 was recommended for the airport. Although it is possible to accommodate about a 200 foot extension to Runway 03, there would be no advantage to constructing a short extension on the approach end of Runway 03. The analysis conducted in the previous master plan resulted in a recommendation to construct the full extension to the northeast. After a review of the previous analysis, a similar conclusion was reached concerning the recommended 1,300 foot extension, which is illustrated on Exhibit 5A.

Parallel Taxiway Extension Alternatives

In the previous master plan, two parallel taxiway configurations were analyzed due to adverse terrain in the runway protection zone area of Runway 21. One option addressed the construction of a parallel taxiway extension, with a 250 foot separation between runway-taxiway centerlines. Another option addressed constructing the parallel taxiway extension on the east side of the runway with a 400 foot runway-taxiway centerline separation. Both alternatives dealt with adverse terrain problems in the areas where

the parallel taxiway would be constructed. The more severe terrain problems were encountered on the west side of the runway extension.

The conclusions reached in the previous master plan were that the cost of a parallel taxiway extension could be reduced by constructing the parallel taxiway segment (1,300 by 50 feet) on the east side of Runway 21. This conclusion was based on the significant reduction in the total cost of constructing a parallel taxiway on the east side versus the west side of the runway, even though the pavement cost would be higher if the taxiway was constructed on the east side.

In a review of the analysis conducted in the previous master plan, a different conclusion was reached concerning the parallel taxiway segment extension. The total cost of the parallel taxiway construction was a significant factor in determining the recommendation in the previous master plan for an east side parallel taxiway extension. In the subsequent analysis, it was determined that the cost differential between the two parallel taxiway extension options was negligible.

In revisiting the cost analysis of the taxiway extension options, it was determined that a significant portion of the earthwork required for the taxiway extension would be included in the runway extension construction. The current FAA design standards for runway construction require that a transverse gradient between 3-5 percent be maintained throughout the runway safety area (an area 250 feet either side of runway centerline). This would provide a significant improvement to the existing gradient and reduce the earthwork required for any future taxiway located within 250 feet of the runway extension.

The existing taxiway is 250 feet from runway centerline and FAA has provided a waiver to the airport for continued use of this taxiway. Therefore, in comparing the two options (a 400 foot runway to parallel taxiway separation on the east side of the runway versus a 250 foot runway-parallel taxiway separation on the west side), the only option that receives any benefit from the required earthwork for the runway extension, is the west side parallel taxiway extension. The resulting construction cost differential between both parallel taxiway options becomes negligible and other factors become more important, such as airfield design continuity.

In any airside development program for an airport, an important consideration is to maintain the existing airfield configuration unless there are safety or other significant factors that would preclude such an approach. Construction of the parallel taxiway on the east side of the runway would require an additional runway crossing by aircraft using Runway 21 for takeoff. Constructing the parallel taxiway segment on the west side will retain the continuity of the airfield configuration.

Therefore, it is recommended that the future parallel taxiway extension be constructed on the west side of the runway extension to Runway 21, as illustrated on **Exhibit 5A**.

Exit Taxiways

During the analysis of demand and capacity conducted in the previous chapter, it was determined that the airport could gain an increase in capacity of approximately 10 percent by constructing another exit taxiway, as illustrated on **Exhibit 5A**. Constructing this exit taxiway will produce an increase in

capacity. Additional increases in capacity would result from changes in peak hour conditions or the construction of a parallel runway.

Navigational Aids

Three new navigational aids are recommended for the airport: a precision instrument landing system, a Runway Visual Range (RVR) instrument and a wind cone for the approach end of Runway 03.

The precision instrument landing system for the airport has been re-evaluated by FAA since the last master plan. The previous FAA review indicated that only a Microwave Landing System (MLS) could provide the desired approach to the airport which would avoid obstructions within the imaginary surfaces for precision instrument approaches (as described in FAR Part 77, Objects Affecting Navigable Airspace).

The FAA subsequently conducted another analysis of the precision instrument landing system capability at Flagstaff Pulliam Airport and determined that an Instrument Landing System (ILS) could also be installed at the airport. An ILS, using an Endfire Glideslope antenna, could produce the desired precision approach path to the airport that would avoid the Elden Mountain obstruction in the Part 77 approach surface.

An approach lighting system is normally installed as part of an ILS or MLS system. A Medium Intensity Approach Lighting System with Runway Alignment Indicators (MALSR) is recommended for this airport. The existing terrain features in the approach to Runway 21, the area where the MALSR would be installed, will result in a higher cost for installing the MALSR approach lighting system. By constructing the runway extension to Runway 21 before installation of the MALSR, a probable relocation cost of approximately \$300,000 can be avoided.

The RVR should be installed on the Runway 21 end because that will be the primary instrument runway at Flagstaff Pulliam Airport. In addition, a lighted wind cone is required at the approach end of Runway 03 due to the variable wind conditions caused by the trees on the east side of the runway. The location of the navigational aids recommended in this plan are illustrated on Exhibit 5A.

RECOMMENDED AIRSIDE ALTERNATIVE

Exhibit 5A illustrates the recommended airside development during the planning period. The installation of the approach lighting system (MALSR) for the precision instrument landing system could be delayed until the runway extension is complete. The runway extension and precision instrument approach will require the airport to obtain an aviation easement for 31 acres of land from the U.S. Forest Service to protect the clear zone northwest of Runway 21. Also indicated on the exhibit is the acquisition of 88 acres of land south of Lake Mary Road and 149 acres of land north of Lake Mary Road to complete the insurance of land use control over the runway protection zone and approach to Runway 21.

LANDSIDE ALTERNATIVES

The facility requirements based upon the enplanement and operational forecasts for the airport were reviewed to determine the sizing and location of facilities to meet future demand. The following elements would be evaluated in the development of alternatives that would provide the necessary facilities.

- Commercial Service Terminal Building
- General Aviation Landside Alternatives

A discussion on each of the major elements and alternative development proposals follows.

COMMERCIAL SERVICE TERMINAL BUILDING ALTERNATIVES

A separate study, **Terminal Building Analysis for Pulliam Airport**, was conducted during the master planning process to evaluate three different methods for eliminating deficiencies in the existing terminal building. The study presented an analysis of the advantages and disadvantages of each alternative. The results of this study and a recommended commercial service terminal plan for the airport are described in the paragraphs to follow.

Terminal Building Alternative A

The original 2,800 square foot building, constructed in 1949, has been expanded on several occasions through the years in order to reach its present size of 6,700 square feet. The current building does not adequately meet the needs of the airport at the present time and would require expansion in order to meet the existing passenger demand. Alternative A examined the feasibility of correcting the existing terminal building physical and functional deficiencies, remodeling and renovating both the interior and exterior of the building, without expanding of the facility.

Four major areas would require attention: compliance with existing building codes, correction of safety deficiencies, inadequate access for the handicapped and the poor esthetics of the building. The estimated cost for remodeling and renovating to correct these problem areas was estimated at approximately \$234,000.

The disadvantage of this alternative is that the building would be located within the BRL when the precision instrument landing system is installed at the airport. The FAA will not participate in funding any expansion of this facility and considers any expenditure of funds to be temporary in nature. This would

require the City of Flagstaff to fund all improvements without federal assistance.

Terminal Building Alternative B

In this alternative, renovation and remodeling of the existing building to correct all of the physical deficiencies would be accomplished similar to Terminal Building Alternative A, including a 3,000 square foot expansion of the facility to meet existing demand. The estimated cost of completing this alternative is \$530,000.

The advantage of this alternative over Terminal Building Alternative A is the improved capability of the terminal due to the expansion. However, the location of the building and the fact that it will be within the building restriction line once the precision instrument landing system is installed, precludes FAA participation in funding of the construction and renovation.

Terminal Building Alternative C

In Terminal Building Alternative C, a completely new facility will be constructed that will meet the forecast demand for the next ten years. This facility will accommodate an annual enplanement level of approximately 85,000 passengers and provide auto parking for approximately 350 automobiles. The plans for a new facility include the relocation of an existing terminal building tenant (National Oceanic and Atmospheric Administration - Weather Service) to an area north of the DPS Hangar and providing space within the terminal for Airport Management.

In Alternative C, two building sites were examined. At both sites the terminal was to be located 745 feet from the runway centerline, meeting the existing as well as future BRL standard. Both potential terminal locations will provide an opportunity to park aircraft and comply with the 500 foot aircraft

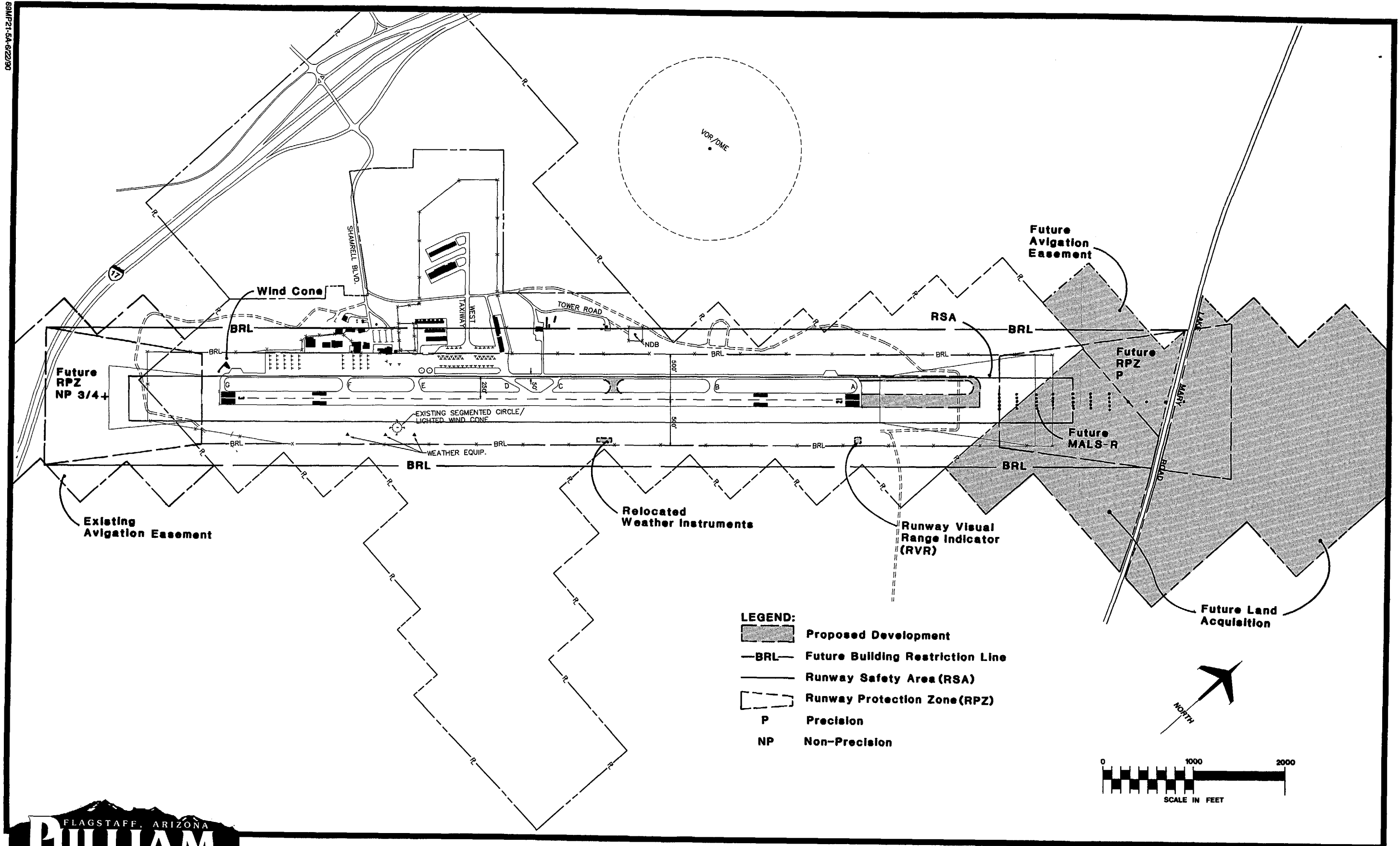


Exhibit 5A
RECOMMENDED AIRSIDE ALTERNATIVE

parking restriction from runway centerline. Each site will provide adequate area for future building expansion.

Terminal Building Alternative C1, illustrated on **Exhibit 5B**, locates the new Terminal building approximately 250 feet behind the existing terminal. In this alternative, automobile parking will be located west of the new terminal building and an aircraft parking apron constructed on the existing automobile parking area. This alternative will require the removal of an underground fuel storage tank, demolition of the existing terminal building and precise construction phasing to minimize passenger inconvenience.

Terminal Building Alternative C2, illustrated on **Exhibit 5C**, is located on the site recommended in the previous master plan, northwest of the existing facility. In this alternative, automobile parking will be located west of the new terminal building and an aircraft parking apron constructed east of the new terminal building. This alternative will require the demolition of the existing T-hangars, construction of a new apron for

aircraft parking and construction of approximately 3,000 linear feet of roadway to provide access to the new terminal building. It is assumed that if this alternative is recommended as the terminal building site, the proposed access road to the terminal building should be included within airport property. This action will require an amendment to the current agreement with FAA for the release of certain properties on the airport for commercial/industrial development (excluding the right-of-way for the access road from the release).

Both terminal locations will require construction of new septic tank systems and extension of utilities, with the cost of utilities being slightly higher for Terminal Building Alternative C2. The existing water supply and pressure are insufficient to provide adequate fire protection at either location, therefore, a 300,000 gallon water storage tank will be required to provide the required fire flow of 2,000 gallons per minute for two hours. **Table 5A** describes the *order of magnitude* costs associated with building either of the terminal building alternatives.

TABLE 5A
New Terminal Building - Construction Costs
Flagstaff Pulliam Airport

<u>ITEM</u>	<u>ALTERNATIVE C1</u>	<u>ALTERNATIVE C2</u>
Terminal Building (15,000 SF)	\$1,875,000	\$1,875,000
Auto Parking (14,000 SY)	420,000	420,000
Building Removal ¹	35,000	NA
Terminal Apron (14,000 SY)	700,000	700,000
Replacement Hangars (12)	NA	300,000
Relocated Building ²	5,000	NA
Relocated Fuel Farm (10,000 GALS)	50,000	NA
Access Road	63,000 ³	475,000 ⁴
Utilities ⁵	<u>450,000</u>	<u>450,000</u>
TOTAL	\$3,598,000	\$4,220,000

NA = Not Applicable

¹ Existing Terminal Building

² America West Cargo Building

³ 2100 Square Yards

⁴ 9500 Square Yards

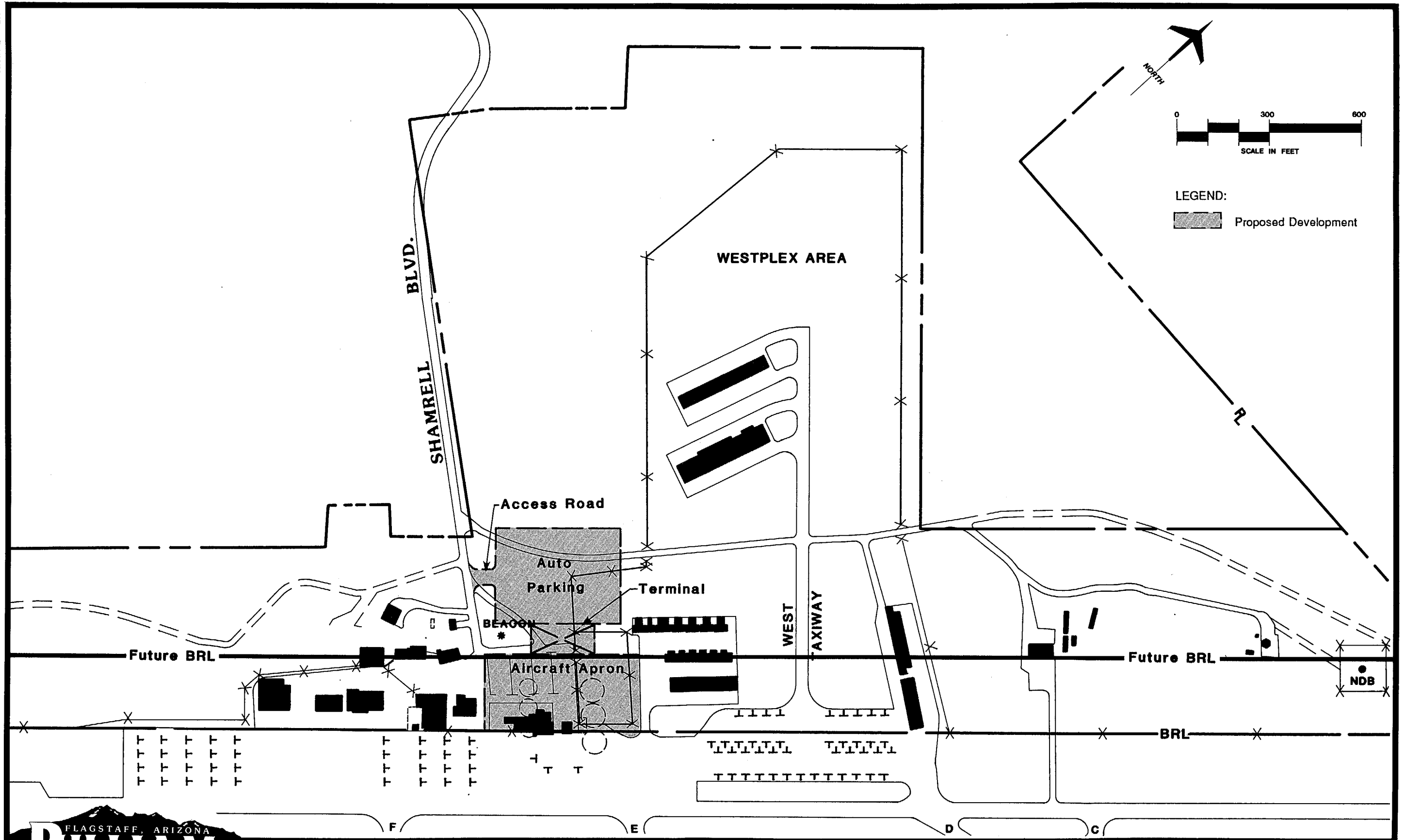
⁵ Includes 300,000 gallon water storage and distribution system

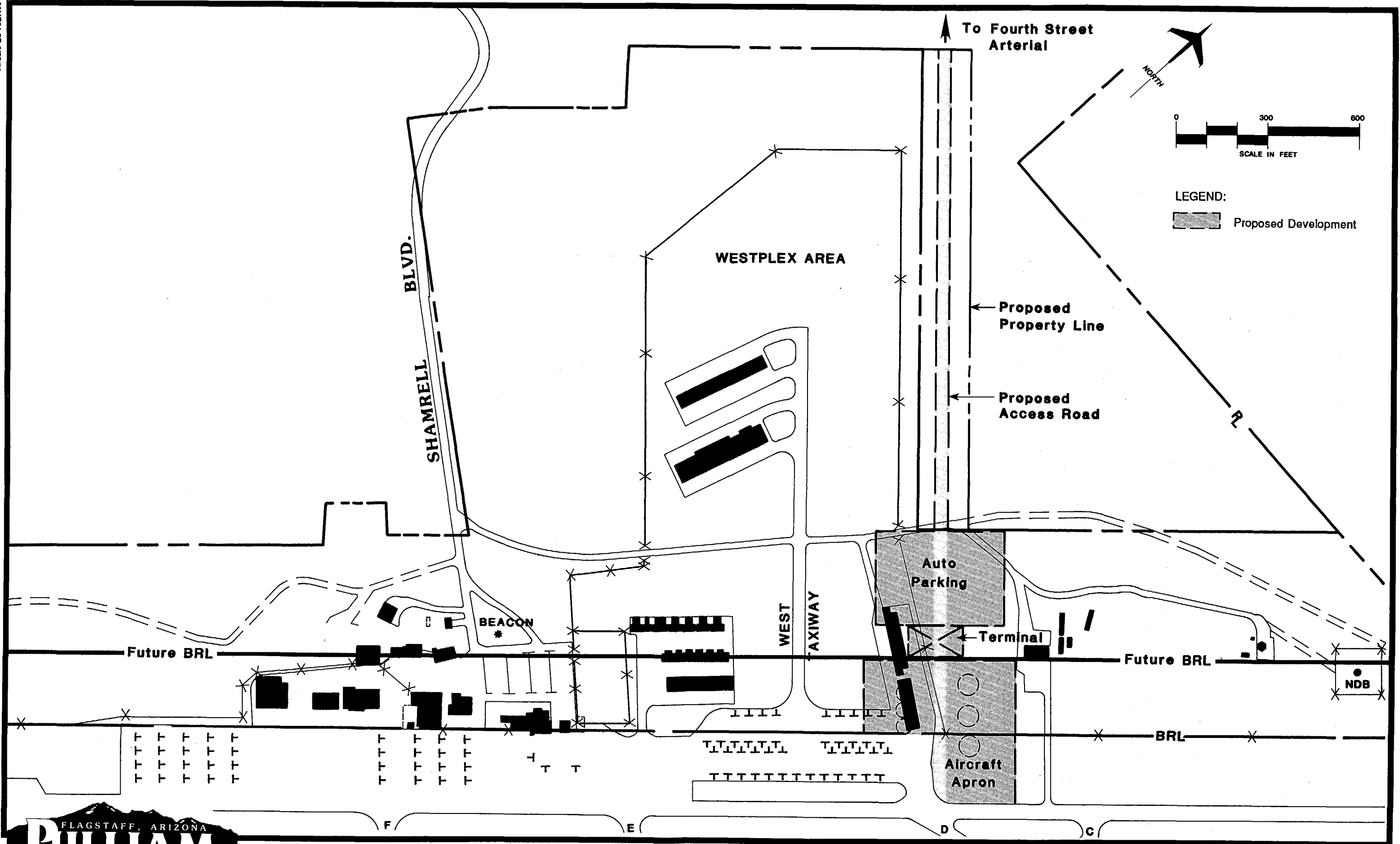
Recommended Terminal Building Alternative

Each of the new terminal locations has certain advantages. Alternative C1 would not require a new access road and the existing road system, with minor modifications, could be designed to support the new terminal in this location. The major problem with the location of the terminal in Alternative C1 is that there is no separation from general aviation activities, a problem that could

become significant in designing security procedures for commercial service airlines.

The biggest disadvantage of Alternative C2 is access to the terminal building. Temporary access can be obtained from Tower Road through Shamrell Boulevard, but eventually, general aviation activities in the Westplex area will require the closure of Tower Road at the dual taxilane in the interest of airport safety. The obvious route to the new terminal would be from an access road to the





Fourth Street arterial, located west of the airport. This road has not as yet been constructed and the City has no immediate plans to begin construction.

The most significant advantage to Alternative C2 is that it provides the opportunity to separate general aviation activity from commercial service activity and reduce the complexity of providing security to commercial service operations. Although a new access road to the terminal building would ultimately be required, temporary access can be obtained from Tower Road. Therefore, **Terminal Building Alternative C2** is the recommended terminal layout for Flagstaff Pulliam Airport.

GENERAL AVIATION LANDSIDE ALTERNATIVES

General Aviation development objectives were threefold:

- Reduce or eliminate aircraft parking within 500 feet of the runway centerline.
- Reduce the number of hangars that will be located within the 745 foot BRL. All future hangars and buildings will be located outside of the 745 foot BRL.
- Maximize the use of the Westplex area for general aviation development.

Several alternative layouts for the Westplex area were examined and three development alternatives were selected for further review. All of these alternatives meet the criteria established for future general aviation development.

General Aviation Alternative I

The major feature of General Aviation Alternative I is the ultimate relocation of all

the existing aircraft parking spaces in order to meet the future aircraft parking-runway centerline separation standard of 500 feet. This will require the relocation of one 10-unit Shade hangar and thirteen (13) portable hangars into the Westplex area. A dual taxilane is planned for the Westplex area as well as connecting taxilanes to serve potential corporate development adjacent to Shamrell Boulevard. In this layout proposal, as illustrated in **Exhibit 5D**, the Terminal Building is assumed to be constructed where the North T-Hangars are presently located.

Orientation of the new shade and T-Hangars will be consistent with the existing arrangement in the Westplex area. The separation between hangars and shades will correspond to separation standards for ADG I and ADG II aircraft, depending upon the location and purpose of the hangar/shade. The north portion of the Westplex area will be the site for relocated port-a-port hangars and 10-Unit shade and will be designed to ADG I separation standards. The shade and T-hangars in the center portion of the Westplex will be designed to meet ADG II separation criteria.

The tiedown area will occupy the area directly east of the Westplex area. This area is large enough to accommodate all the aircraft parking requirements throughout the planning period. Both ADG I and ADG II aircraft parking has been planned in this area. All pavement strengths will be predicated on the ADG of the aircraft using the pavement area.

Automobile parking has been located in three different areas in order to meet the forecast demand. A large parking area east of the Westplex area will accommodate approximately 250 cars while the smaller parking lot in the west-central portion of the Westplex will serve approximately 42 vehicles. The parking lot adjacent to the proposed access road to the new terminal will serve approximately 80 vehicles.

The advantage to this layout is the wide separation of hangars/shades in the central portion of the Westplex which will allow a great deal of flexibility in the size of the aircraft that the area will accommodate. The main disadvantage of this arrangement is that this degree of separation between hangars does not produce an efficient use of the available property. Expansion beyond the 20-year time frame may be limited. The major features of this alternative are compared in Table 5B.

General Aviation Alternative II

General Aviation Alternative II is similar in approach to Alternative I in that the portable hangars and shade hangars located within the future BRL will be relocated to the Westplex area. Similar design standards (ADG I and ADG II) will be applied to the hangars and shades depending upon their location in the Westplex area.

In this alternative as in Alternative I, the construction of the new terminal building is expected to take place at the North T-Hangar area. The two most significant design changes, as illustrated in Exhibit 5E, are the addition of more property to the Westplex area (moving the north property line to contain the future Terminal Building access road) and a new hangar/shade layout.

The hangars and shades will be constructed along a similar orientation as the present T-Hangar and shade. The separation between nested hangars will be in accordance with ADG II criteria. This separation, 115 feet versus 160 feet in Alternative I, will make more efficient use of the area. Although the apron pavement requirements in the center of the Westplex area are the highest of any alternative, a much greater percentage utilization is made of the available property. This alternative will provide more room for future expansion and allow the flexibility to change from small hangars to corporate or

larger hangar construction, both north and south of the center of the Westplex.

The local and transient tiedown area is located in a similar manner as in Alternative I, except that some tiedowns are located north of the dual taxilane.

Automobile parking is distributed in a manner similar to Alternative I: east of the Westplex area, north of the corporate/conventional hangar area and in the western portion of the Westplex. Although the total parking spaces are slightly less than can be accommodated in Alternative I, there is enough planned parking to meet forecast general aviation demand.

The advantage of Alternative II is the more efficient use of the Westplex property and the flexibility to expand hangar/shade requirements in the designated corporate/conventional hangar area with only minor modifications to the layout design. Table 5B compares the features of Alternative II with the other alternatives.

General Aviation Alternative III

Exhibit 5F depicts a layout design for the Westplex area if the Terminal Building construction take place west of the existing location. In this alternative, hangars and shades are oriented in a layout similar to Alternative I. As in the previous alternatives, the primary objectives were incorporated into this plan as well.

The separation between hangars/shades in the central portion of the Westplex area is similar to Alternative I, allowing for more flexibility in the size of aircraft using this area. ADG I separation standards are applied to the hangars and shades in the north portion of the Westplex. The corporate/conventional hangar area is located east of Westplex in this design, with the local and transient tiedown areas east of the conventional hangars.

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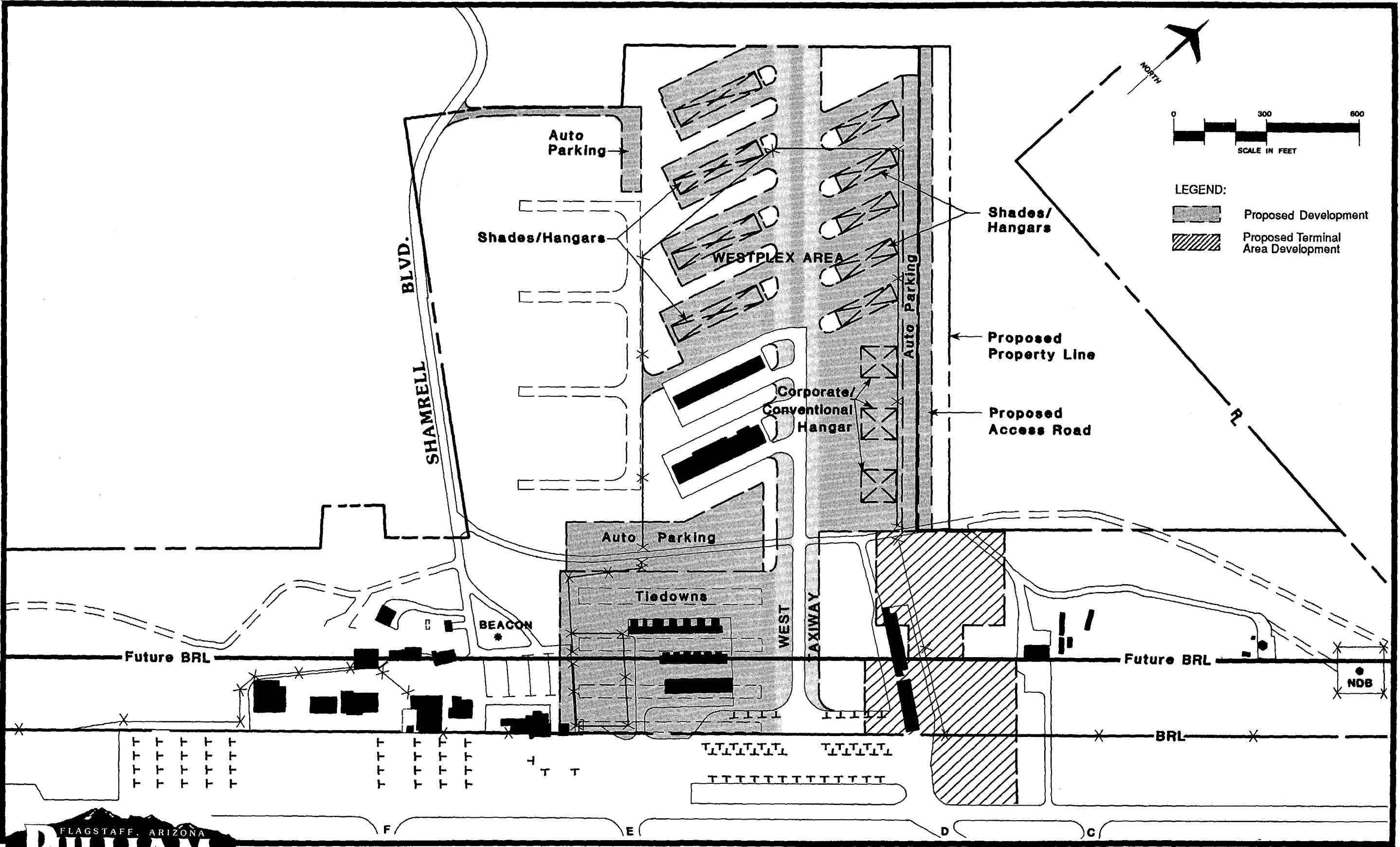


Exhibit 5D
GENERAL AVIATION ALTERNATIVE I

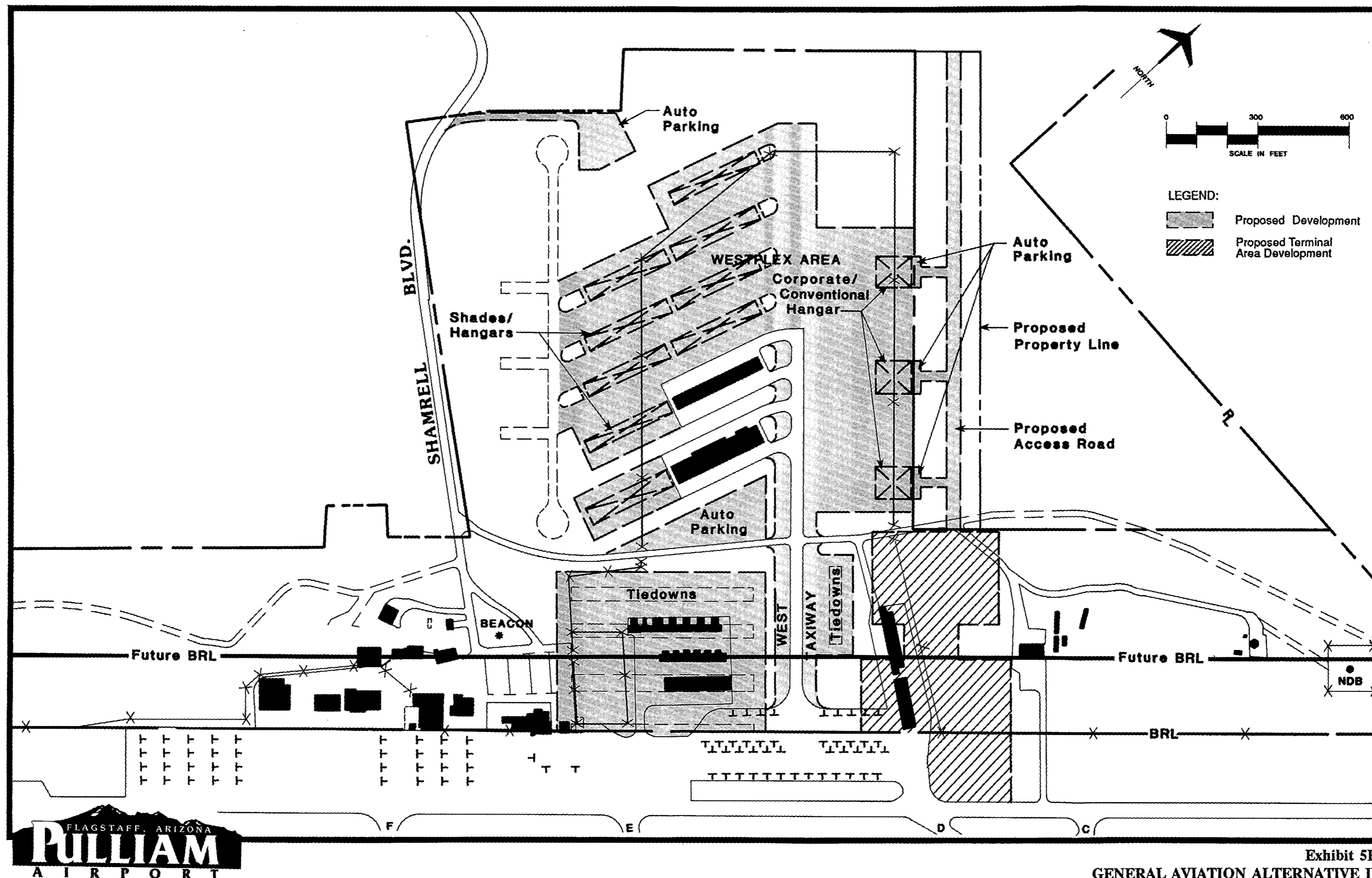
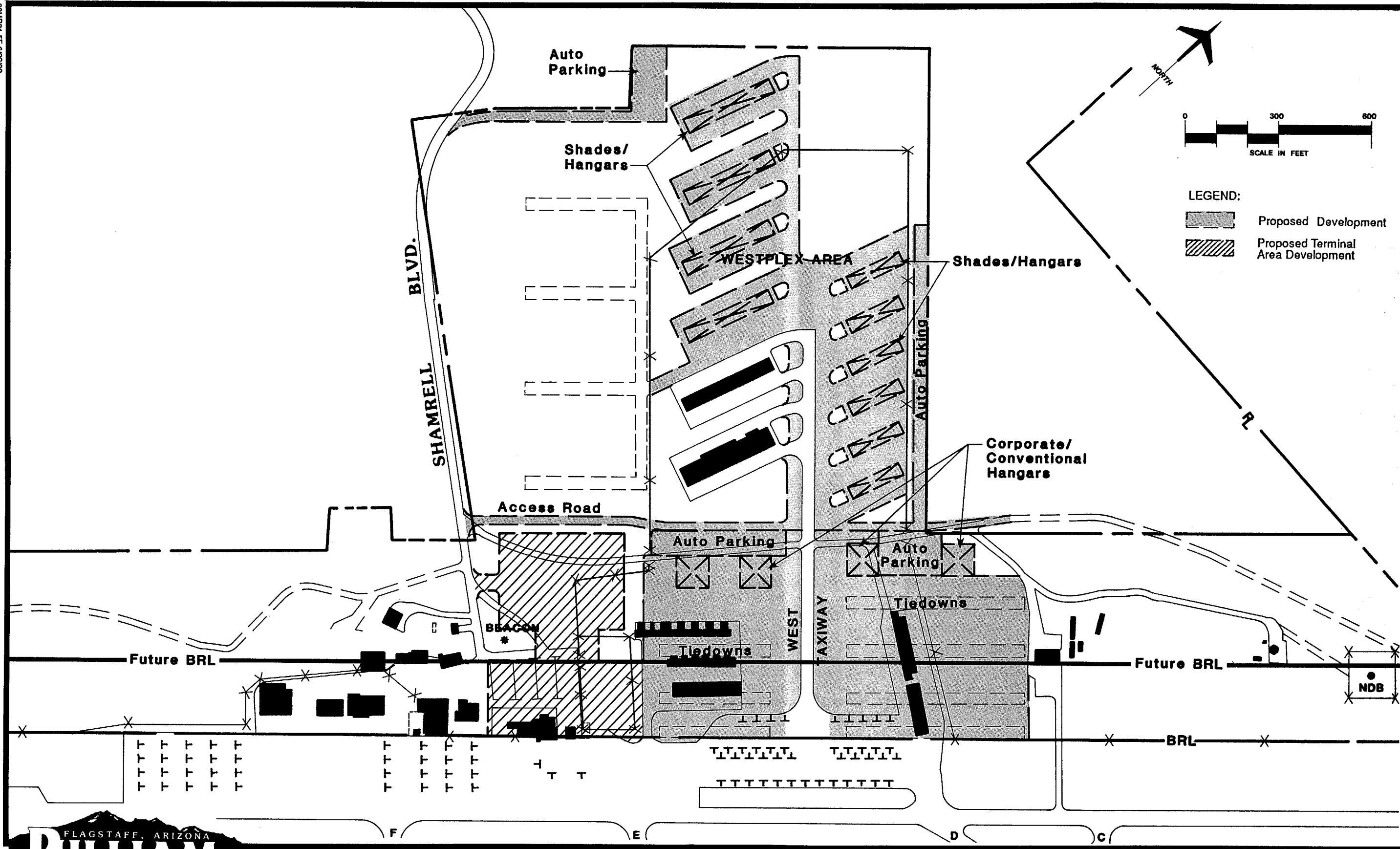


Exhibit 5E
GENERAL AVIATION ALTERNATIVE II



The advantage of this design is the flexibility to accommodate larger aircraft in the central portion of the Westplex. The corporate/conventional hangar area would provide the best location for an additional FBO as the relationship of general aviation activities favors an FBO operation in this area.

There are three disadvantages to this alternative. The corporate/conventional hangar area has a limited potential for expansion. The expansion of the Terminal Building apron is restricted and the amount of property north of the dual taxilane limits the size of hangars/shades in the area. The major features of this alternative are outlined in Table 5B.

TABLE 5B

**Summary of General Aviation Alternatives - Major Construction Elements
Flagstaff Pulliam Airport**

	Aircraft Parking Apron (SY)	Dual Taxilanes (SY)	Other Taxilanes (SY)	Center ¹ Shade/ T-Hgr Apron (SY)	North ¹ Shade/ T-Hgr Apron (SY)	Auto Parking (SY)	Internal Access Roads (SY)	Corporate/ Conventional Hgr Apron (SY)
Alternative I	38,900	28,000	2,000	27,800	19,500	14,800	1,900	12,400
Alternative II	43,500	28,600	3,100	55,000	N/A	10,200	1,700	20,200
Alternative III	55,600	20,500	5,000	27,800	27,800	7,200	4,000	11,300

Note: ¹ Center and North apron areas refer to the hangar locations in the Westplex area as illustrated on Exhibits 5D, 5E, 5F and 5G.

² Corporate/Conventional apron is the apron required to support the large 100 foot hangars illustrated on Exhibits 5D, 5E, 5F and 5G.

**Recommended General
Aviation Alternative**

A comparison of the general aviation landside development alternatives is presented in Table 5B. After a review of the various alternatives with the Planning Advisory Committee, a modified version of General Aviation Alternative I was selected as the recommended alternative and is illustrated on Exhibit 5G. The location of the new terminal building played an important role in the selection of the recommended development plan. The recommended alternative incorporates these features:

- The north property line in the Westplex area is extended to include the access road to the new Terminal Building.
- The separation between hangars and shades was reduced to the minimum distance required for the appropriate Airplane Design Group.
- A provision to increase the ultimate design width of the dual taxilanes to ADG II standards.
- A flexible design to incorporate corporate parcels and/or future FBO's at several locations within Westplex.

CONCLUSION

The recommended direction of the development for the planning period is focused on correcting existing airport deficiencies and providing facilities to meet the future demand. These recommendations can be summarized as follows:

• AIRSIDE

- Extend Runway 03-21 to 8,300 feet by 150 feet.
- Extend the parallel taxiway along the west side of the Runway 21 extension.
- Improve the load bearing capacity of the runway and taxiways.
- Relocate the existing weather instruments.
- Remove obstructions to the FAA Part 77 imaginary surfaces.
- Install an RVR instrument at the approach end of Runway 21
- Acquire approximately 237 acres of land for approach protection and runway protection zone requirements.
- Acquire avigation easements for 31 acres of land for runway protection zone and approach protection.

• LANDSIDE

- Construct a new Terminal Building northwest of the existing facility.

- Reduce the number of aircraft parked within the future runway centerline-to parked aircraft separation of 500 feet.
- Reduce the number of hangars and buildings located within the 745 foot future Building Restriction Line.
- Increase the size of the existing Westplex area by extending the property line 75 feet to the north.
- Construct a dual taxilane in the Westplex area in order to accommodate ADG II aircraft.
- Provide ADG II separation criteria to the hangars/shades in the central portion of the Westplex area.
- Provide ADG I separation criteria to hangars and shades constructed in the north portion of the Westplex area.

At this point, a basic development concept has been recommended for Flagstaff Pulliam Airport. The remaining chapters will present refinements of this concept and an analysis of its financial feasibility. These chapters will produce the management tools necessary to ensure implementation and proper timing of the projects in the development program.

